Methodology
STORMWATER MITIGATION

WSDOT corrects and avoids problems created by stormwater runoff by applying physical, structural, and managerial practices that prevent or reduce runoff damage. Examples include retention ponds, biofiltration swales, and road sweepings. Existing highway sections that have no stormwater treatment, or where treatment is substandard, are improved in conjunction with new highway improvements. Highway stormwater management systems include: providing runoff treatment to meet water quality standards; recharging groundwater; preventing instream erosion; and controlling the rate and duration of storm flows from state right of way. There are many recent examples where significant water quality benefits have been secured in WSDOT projects. The following lists some typical items associated with stormwater management cost calculations.

Calculation of stormwater mitigation costs typically includes, but is not limited to, the following items:

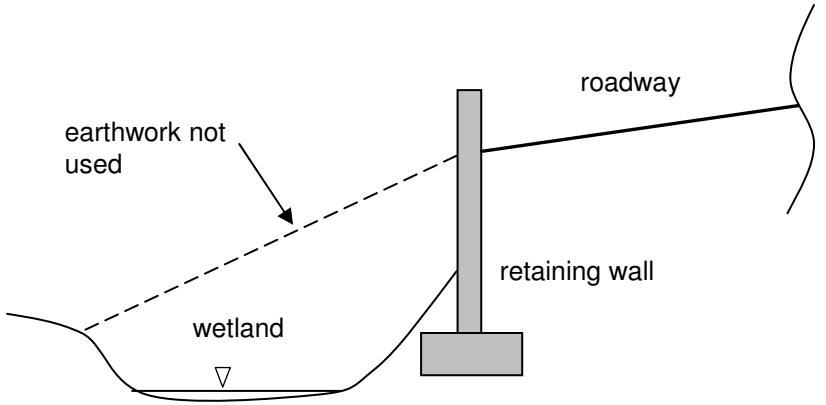
- Excavation and embankment
- All bid items associated with stormwater once it leaves a catch basin or inlet
- All bid items associated with conveyance of stormwater to the treatment facility
- Pipes and inlets
- Vaults and ponds
- Bioswales
- Maintenance access roads to facility
- Erosion control and planting
- Seeding
- Additional fencing
- Right of way costs associated with stormwater management

Methodology
WETLAND MITIGATION

When transportation projects create unavoidable wetland impacts, wetlands are enhanced, restored, created, or preserved. Wetland mitigation costs vary based on the type of impact, cost of real estate, and the required replacement ratio. Another contributing factor is the local jurisdiction in which the project resides (the number of acres replaced divided by the number of acres impacted).

Wetland Avoidance & Mitigation Costs typically include, but are not limited to:

- All items required to restore wetland (i.e., excavation and embankment construction, vegetation)
- Right of way required for wetland mitigation (actual acquisition costs)
- Any items required as a condition of wetland permit
- Removal of invasive plant species
- Vegetation
- Silt fence
- High visibility fencing

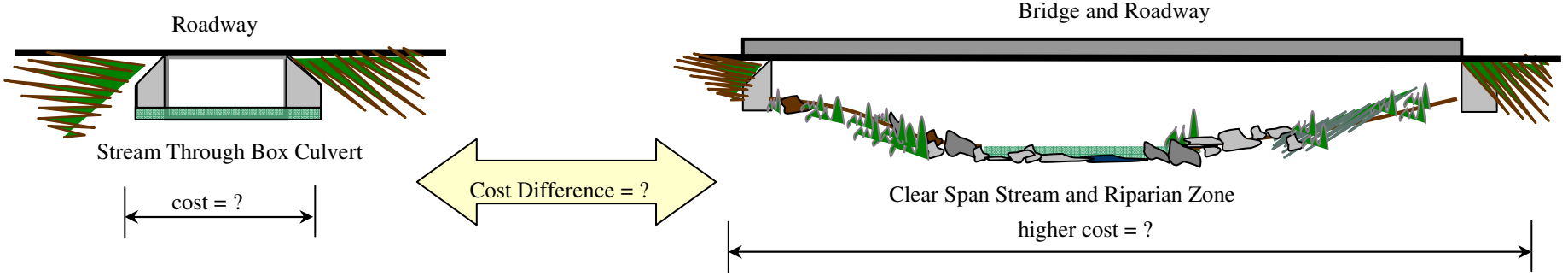


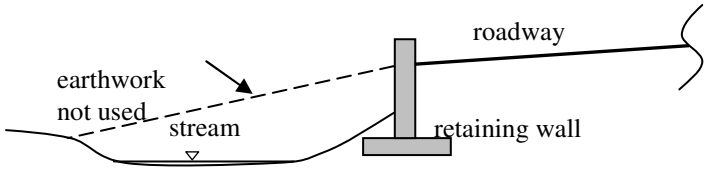
Retaining Wall Used to Avoid Wetland

Retaining walls can be used to avoid a wetland or to minimize impacts. The avoidance cost is reported as: in-place cost of wall minus the cost of earthwork that would have been used had the wetland not been there.

Methodology
STREAM MITIGATION

Protection of rivers and streams is critical and can influence the design and construction elements of roadways and bridges. There are multiple types of stream protection actions including enhancements to the riparian, or a bridge span over a stream that is wider than the actual width of the stream. For example, if a stream is 10 feet wide and a box culvert of that dimension would sufficiently carry a roadway over the stream, but permit conditions require a clear span bridge 50 feet long to protect the stream and its buffer environment, then a mitigation cost difference can be realized and reported.





Stream Avoidance Using Wall

These drawings illustrate various types of designs at streams. The box culvert in-place cost versus the clear span in-place cost of the bridge over the stream are important considerations.

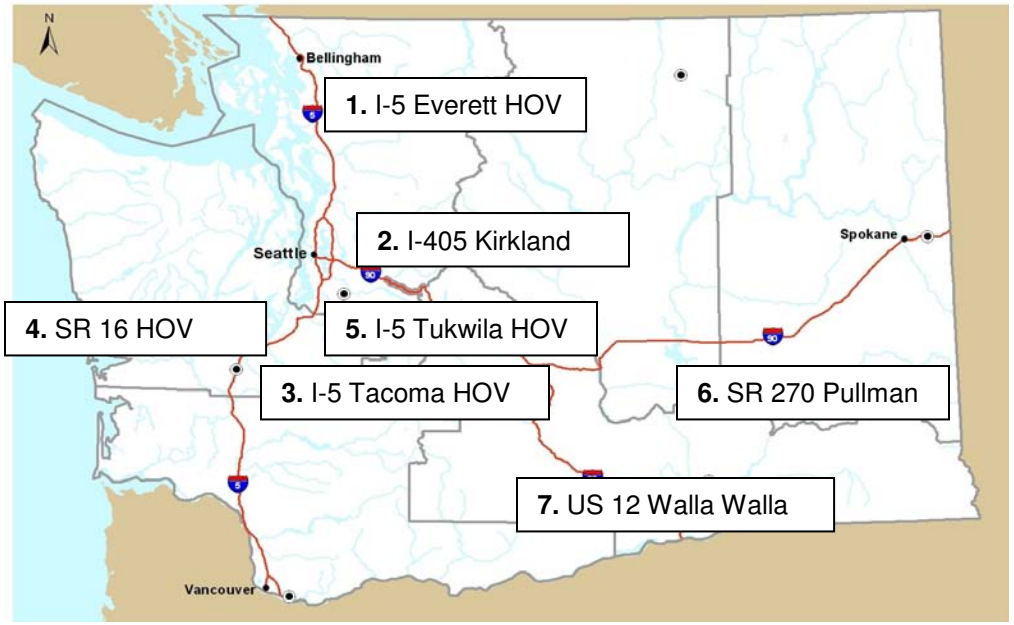
The retaining wall shown illustrates minimizing or avoiding a sensitive area by reducing the "footprint" of the roadway cross section, at a cost.

Methodology
NOISE MITIGATION

Federal law and state policy require that every project that adds through-lanes or significantly realigns roadways must receive a noise evaluation. Outdoor noise impacts (66+ decibels) on locations like homes, schools, churches, day care centers, and hospitals trigger evaluation of whether noise mitigation (e.g., walls, earth berms) will be meaningful and cost-effective. The result is that WSDOT builds many noise barriers that generally halve residents' perception of traffic noise. From 1963 to 2000, we built approximately 65 miles of noise barriers throughout the state. From 2000 and into the future, we are building even more as a part of our construction projects in urban areas. The cost of noise barriers can vary based on the availability of right of way and the materials used.

Noise abatement costs include, but are not be limited to:

- Cost of barriers in place
- Excavation and embankment
- Right of way costs associated with noise barrier
- Concrete foundations and walls
- Clearing and grubbing
- Wall fascia treatments



Project Case Studies

1. I-5 Everett, SR 526 to US 2 HOV
Widens I-5 to add HOV and auxiliary lanes
Project cost: **$219.2M**
Approximately **24.4%** of the total project cost will be used for noise walls, detention facilities to control stormwater runoff, and wetlands replacement.

2. I-405 Kirkland, SR 520 to SR 522
Constructs 10.5 lane miles of additional capacity and interchange improvements
Project cost: **$164M**
Approximately **21%** of the total project cost will be allocated for noise walls, detention facilities to control stormwater runoff, wetlands replacement and restoration, and fish barrier.

3. I-5 Tacoma HOV improvements
Widens I-5 to add HOV and auxiliary lanes
Project cost: **$107.6M**
Approximately **7.7%** of the total project cost will be used for noise walls and detention facilities to control stormwater runoff.

4. SR 16 HOV improvements – Union Avenue to Jackson
Widens SR 16 to add HOV and auxiliary lanes
Project cost: **$72.0M**
Approximately **13.1%** of the total project cost will be used for noise walls, detention facilities to control stormwater runoff, and wetlands replacement and restoration.

5. I-5 Tukwila – HOV Pierce to Tukwila Stage 4
Widens I-5 to provide NB and SB HOV lanes from Pierce County line to S. 320th Street
Project cost: **$38.7M**
Approximately **7%** of the total project cost will be used for noise walls and detention facilities to control stormwater runoff.

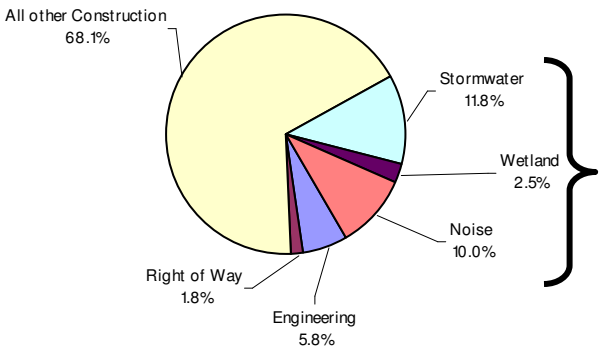
6. SR 270 Pullman to Idaho State Line
Widens from two lanes to four lanes
Project cost: **$29.9M**
Approximately **10%** of the total project cost will be used for stream enhancement and detention facilities to control stormwater runoff.

7. US 12 Walla Walla – Attalia Vicinity
Added two lanes to create a 3-mile, 4-lane highway
Project cost: **$10.3M**
Approximately **1%** of the total project cost was used for facilities to control stormwater runoff.

How mitigation costs affect the cost per lane mile:

Congestion relief and HOV lanes are $17.4M per lane mile.

Total project cost is $219.2M for 12.6 new lane miles.

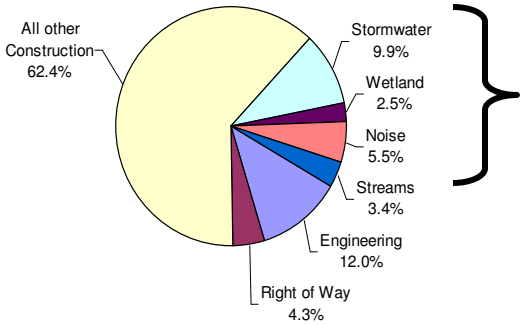


Mitigation 24.4%

I-5 Everett – HOV

Congestion relief is $15.6M per lane mile.

Total project cost is $163.7M for 10.5 new lane miles.



Mitigation 21%

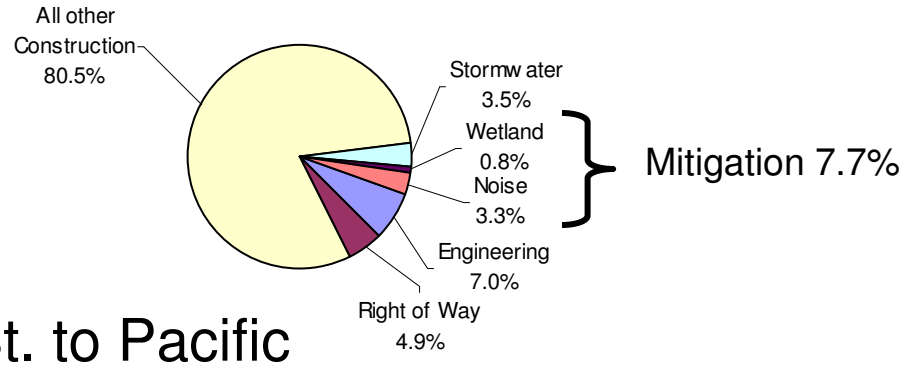
I-405, SR 520 to SR 522

Note: Mitigation percentages include R/W, engineering, construction and applicable taxes

How mitigation costs affect the cost per lane mile:

Congestion relief and HOV lanes are $14.5M per lane mile.

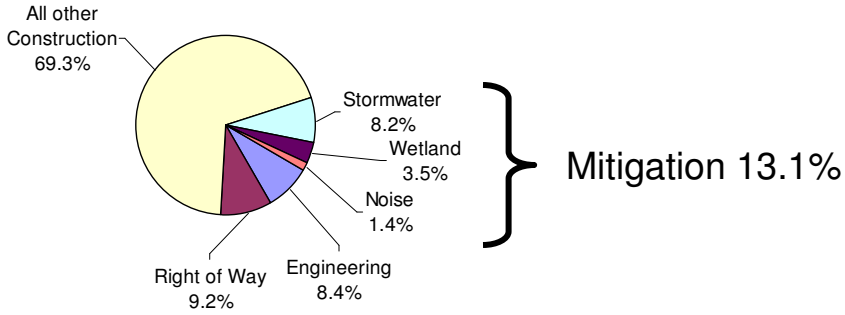
Total project cost is $107.6M for 7.4 new lane miles.



I-5 Tacoma HOV – South 48th St. to Pacific

Congestion relief and HOV lanes are $3.1M per lane mile.

Total project cost is $72.0M for 23 new lane miles.



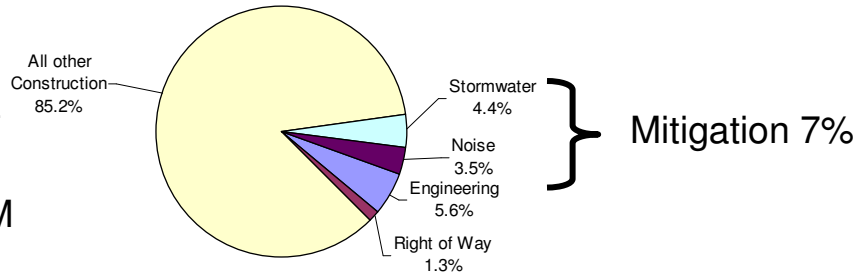
SR 16 HOV – Union to Jackson

Note: Mitigation percentages include R/W, engineering, construction and applicable taxes

How mitigation costs affect the cost per lane mile:

Add two new HOV lanes—
$5.0M per lane mile.

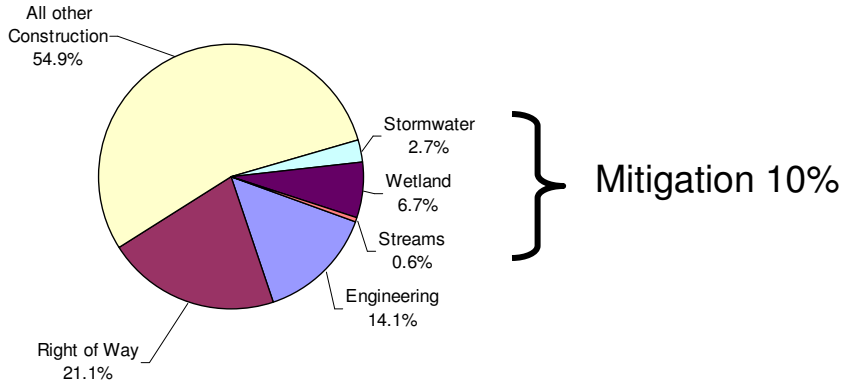
Total project cost is $38.7M
for 7.76 new lane miles.



I-5 Pierce Co. Line to Tukwila – HOV

Rural capacity improvement
$1.5M per lane mile.

Total project cost is $29.9M
for 20 lane miles.



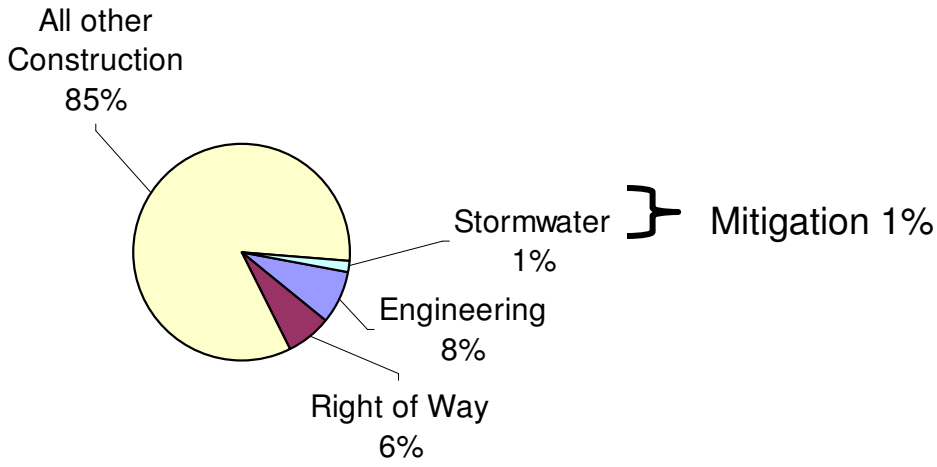
SR 270 Pullman to Idaho State Line

Note: Mitigation percentages include R/W, engineering, construction and applicable taxes

How mitigation costs affect the cost per lane mile:

Add two new lanes for 3.2 miles; $2.4M per lane mile.

Total project cost is $15.5M for 6.4 new lane miles.



US 12 – Attalia Vicinity

Note: Mitigation percentages include R/W, engineering, construction and applicable taxes

For these case studies, the cost per lane mile varied from $1.5M per lane mile to $17.4M per lane mile. This was mostly due to the complexities of the projects, not the mitigation items. The urban projects with complex structures and retaining walls have a much higher cost per lane mile than the rural widening projects.